* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] It is the control approach whenever [in the high-frequency induction heating which makes the resonance state the resonance circuit which has a high-frequency-induction-heating coil, and is characterized by controlling whenever / stoving temperature / of said heated object / by the bottom of this resonance state based on the resonance frequency which changes in connection with the temperature rise of a heated object / stoving temperature].
[Claim 2] It is the control approach whenever [in the high-frequency induction heating according to claim 1 characterized by said heated object being a catalytic converter for exhaust gas purification of an automobile / stoving temperature].
[Claim 3] (a) The RF generator section and the resonance circuit to which it changes from the series circuit of the high-frequency-induction-heating coil which carries out high frequency induction heating of the (b) heated object, and a capacitor, and an RF generator is supplied from said RF generator section, (c) The phase control circuit which controls the power line period of said RF power supply section to make mostly in agreement the phase of the high-frequency voltage outputted from said RF power supply section, and the phase of the high frequency current which flows in said high-frequency-induction-heating coil, and to always make said resonance circuit into the resonance state, (d) The flag signal generating circuit which detects that the power line period of said RF power supply section turned into a predetermined frequency, and generates a predetermined flag signal, Each provide and it responds to the impedance of said high-frequency-induction-heating coil changing in connection with the temperature rise of said heated object. The high-frequency induction heating of said heated object is continued always making said resonance circuit into the resonance state by said control circuit. The high-frequency-induction-heating temperature controller characterized by constituting based on the flag signal outputted from a flag signal generating circuit when the resonance frequency of said resonance circuit turns into a frequency defined beforehand so that the supply of a power source to said resonance circuit from said RF power supply section may be intercepted.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the circuitry Fig. of the important section of the high-frequency-induction-heating temperature controller used in order to enforce the control approach whenever [concerning this invention / stoving temperature].
[Drawing 2] It is the perspective view showing the condition of having put in the catalytic converter which is a heated object in the high-frequency-induction-heating coil.
[Drawing 3] The inductance L and relative permeability mus of a high-frequency-induction-heating coil It is the graph which shows relation.
[Drawing 4] Temperature T and relative permeability mus of a heated object It is the graph which shows relation.
[Drawing 5] It is the graph which shows the relation between the temperature T of a heated object, and the inductance L of a high-frequency-induction-heating coil.
[Drawing 6] Temperature T and resonance frequency f0 of a heated object It is the graph which shows relation.
[Drawing 7] It is the circuitry Fig. showing the example of the high-frequency-induction-heating temperature controller concerning this invention.
[Drawing 8] It is the graph which shows the temperature T in the location r of the catalytic converter which is a heated object.
[Drawing 9] It is the graph which shows relation with the temperature T of heating time t and a catalytic converter.
[Drawing 10] Heating time t and resonance frequency f0 It is the graph which shows relation.
[Drawing 11] It is the graph which shows relation with the temperature T of heating time t and a catalytic converter.
[Drawing 12] It is the circuitry Fig. of the conventional high-frequency-induction-heating temperature controller.
[Description of Notations]
1 12 High-frequency-induction-heating temperature controller
2 DC Power Supply
3 Inverter
4 Resonance Circuit
5 Resonant Capacitor
6 High-frequency-Induction-Heating Coil
8 PLL Circuit
9 Catalytic Converter as a Heated Object
10 RF Power Supply Section
15 Phase Control Circuit
16 Flag Signal Generating Circuit
17 Circuit Changing Switch

20 Phase Comparator
22 Voltage Controlled Oscillator
26 Frequency Comparator
f0 Resonance frequency
T Whenever [stoving temperature / of a heated object]

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] Whenever [in high-frequency induction heating / stoving temperature], about the control approach and a high-frequency-induction-heating temperature controller, in case this invention carries out high-frequency induction heating of the heated object especially using a high-frequency-induction-heating coil, it is applied to controlling whenever [stoving temperature / of a heated object] correctly, and relates to the suitable control approach and a suitable control unit.
[0002]
[Description of the Prior Art] Since the catalytic converter for exhaust gas purification arranged in the middle of the exhaust pipe of an automobile is in the condition of having been heated by the elevated temperature with exhaust gas at the time of transit of an automobile, a cleaning effect is performed effectively, but at the time of engine starting, since a catalytic converter is ordinary temperature, a purification function is not performed effectively. So, in order to make the cleaning effect of the exhaust gas in the time of engine starting etc. fully perform, it is necessary to heat a catalytic converter compulsorily at the time of engine starting etc.
[0003] Therefore, he is trying to use in the former the approach of passing a direct current directly to a catalytic converter, and performing Joule heating as the heating approach of a catalytic converter. Drawing 12 R> 2 shows the high-frequency-induction-heating temperature controller 50 used from the former for enforcing this conventional heating approach, and this equipment 50 is for heating a catalytic converter (heated object) 51 to the temperature set up beforehand.
[0004] If it is in this conventional high-frequency-induction-heating temperature controller 50, it is constituted so that Joule heating of the power may be supplied and carried out to the catalytic converter 51 which is a heated object from DC power supply 52, and whenever [stoving temperature / of a catalytic converter 51] is detected with the thermocouple temperature sensor 53 attached in the catalytic converter 51. And from the thermocouple temperature sensor 53, the voltage signal proportional to detection temperature is outputted, it is inputted into a comparator 54, and this input voltage is mutually compared with predetermined reference voltage.
[0005] When the detection temperature detected with the thermocouple temperature sensor 53 exceeds the reference temperature defined beforehand, a predetermined control signal is outputted from said comparator 54, the powering-on switch 55 is switched to an OFF state from an ON state by this control signal, the current supply to a catalytic converter 51 is intercepted, and heating of a catalytic converter 51 is suspended according to this.
[0006] It is the actual condition which is being controlled by such circuit actuation in this way so that a catalytic converter 51 heats to predetermined laying temperature and does not become more than the laying temperature.
[0007]
[Problem(s) to be Solved by the Invention] however, since he is trying to heat a catalytic converter 51 with a direct energization method, the heating is boiled comparatively and it enables it to perform it in a

short time, if it is in the conventional high-frequency-induction-heating temperature control approach and the conventional high-frequency-induction-heating temperature controller 50 like **** -- being alike -- a very thick lead wire is needed for a mass DC-power-supply list, and it is unsuitable as an object for automobiles.

[0008] Moreover, in order to contact this thermocouple temperature sensor 53 to a catalytic converter 51 and to perform temperature detection, using the thermocouple temperature sensor 53 as a detection means of whenever [stoving temperature / of a catalytic converter 51], there are the following faults. That is, since the thermocouple temperature sensor 53 will also be heated by the elevated temperature according to a catalytic converter 51 being heated by the elevated temperature with hot exhaust gas at the time of transit of an automobile (at the time of engine continuation actuation), the thermocouple temperature sensor 53 tends to deteriorate at an early stage. Therefore, a problem is in the endurance of the thermocouple temperature sensor 53, and there is a possibility that it may become impossible to perform exact temperature detection. Furthermore, mechanical oscillation tends to get across to the thermocouple temperature sensor 53 through a catalytic converter 51, the thermocouple temperature sensor 53 separates from a catalytic converter 51 by big mechanical oscillation, and there is also a possibility of causing the situation where the function as a temperature detection means cannot be achieved.

[0009] In addition, although setting up and carrying out high frequency induction heating of the heating time to predetermined time by the timer, without using the thermocouple temperature sensor 53 is also considered, in this case, it originates in the dimension of a heated object, the variation of the quality of the material, degradation of the quality of the material with time, etc., variation is produced in whenever [stoving temperature], and the actual condition cannot perform highly precise high frequency induction heating.

[0010] This invention is made in order to cancel such a trouble , and without using temperature detection of a heated object for the thermocouple temperature sensor of a contact process etc. in heating a heated object by the high-frequency induction heating method , the purpose can perform temperature detection of a heated object correctly by the non-contact method , and is to offer the control approach and a high-frequency induction heating temperature controller whenever [in the high-frequency induction heating which was excellent also in respect of endurance / stoving temperature] .

[0011]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, he makes into the resonance state the resonance circuit which has a high-frequency-induction-heating coil, and is trying to control whenever [stoving temperature / of said heated object] by the control approach concerning this invention based on the resonance frequency which changes in connection with the temperature rise of a heated object under this resonance state.

[0012] Moreover, by the control approach concerning this invention, said heated object is used as the catalytic converter for exhaust gas purification of an automobile in the control approach whenever [above-mentioned stoving temperature].

[0013] Moreover, the resonance circuit to which it changes from the series circuit of the high-frequency-induction-heating coil which carries out high frequency induction heating of the (b) heated object to (a) RF generator section at the control unit concerning this invention, and a capacitor, and an RF generator is supplied from said RF generator section, (c) The phase control circuit which controls the power line period of said RF power supply section to make mostly in agreement the phase of the high-frequency voltage outputted from said RF power supply section, and the phase of the high frequency current which flows in said high-frequency-induction-heating coil, and to always make said resonance circuit into the resonance state, (d) The flag signal generating circuit which detects that the power line period of said RF power supply section turned into a predetermined frequency, and generates a predetermined flag signal, Each provide and it responds to the impedance of said high-frequency-induction-heating coil changing in connection with the temperature rise of said heated object. The high-frequency induction heating of said heated object is continued always making said resonance circuit into the resonance state by said control circuit. When the resonance frequency of said resonance circuit turns into a frequency defined

beforehand, based on the flag signal outputted from a flag signal generating circuit, it constitutes so that the supply of a power source to said resonance circuit from said RF power supply section may be intercepted.
[0014]
[Function] The resonance frequency at the time of making into the resonance state the resonance circuit which has a high-frequency-induction-heating coil changes in connection with the temperature rise of a heated object. Therefore, by searching for the temperature change of a heated object beforehand by making resonance frequency at the time of always making said resonance circuit into the resonance state into a parameter, whenever [stoving temperature / of a heated object] can be detected based on this resonance frequency, and control of whenever [stoving temperature] can be performed by suspending heating of a heated object according to this detection.
[0015]
[Example] Hereafter, with reference to drawing 1 - drawing 11 , it explains to a detail per example of this invention.
[0016] First, drawing 1 shows the important section of the high-frequency-induction-heating temperature controller 1 used in order to enforce the control approach whenever [in the high-frequency induction heating concerning this invention / stoving temperature]. The resonance circuit where the inverter from which 2 changes into an RF generator DC power supply and the DC power supply to which 3 is supplied from these DC power supply 2 in this drawing, and 4 consist of the series circuit of the resonant capacitor 5 with which high-frequency power is supplied from this inverter 3, and the high-frequency-induction-heating coil 6, the current transformer (CT) which detects the high frequency current to which 7 flows in the high-frequency-induction-heating coil 6, and 8 are PLL oscillator circuits to which the output voltage of the current which flows to this current transformer 7, and said inverter 3 be supplied as an input.
[0017] Moreover, in drawing 1 , 9 is a heated object by which high-frequency induction heating is carried out with the high-frequency-induction-heating coil 6, and the heated object of this example is a catalytic converter for exhaust gas purification used for the exhaust pipe of an automobile. In addition, the steel plate of one sheet which has catalyst beds, such as platinum, is spirally wound around a front face, it grows into it, and the high-frequency-induction-heating coil 6 is arranged in the shape of the same axle around a catalytic converter 9 so that this catalytic converter 9 may be specified in drawing 2 .

[0018] In the case of this equipment 1, actuation control of the inverter 3 is carried out based on the frequency f of the control signal outputted from the PLL oscillator circuit 8, and it consists of inverters 3 so that the high-frequency power of the same frequency as that frequency f may be outputted and a resonance circuit 4 may always be in the resonance state.
[0019] Here, it is the impedance Zr of the high-frequency-induction-heating coil 6. Impedance Z0 seen from the power-source side when it expressed, as shown in the following formula (a) Since it is the series circuit of resonant capacitor C and the high-frequency-induction-heating coil 6, it is expressed like the following formula (b).
[0020]
[Equation 1]

$$Z_r = r + j \cdot 2\pi f \cdot L \quad \cdots\cdots\cdots \quad \text{(a)}$$

（但し、rは高周波誘導加熱コイル6内に触媒コンバータ9を入れたときの前記コイル6の純抵抗分、Lは前記コイル6のインダクタンス、fは周波数）

[0021]
[Equation 2]

$$Z_0 = (r + j \cdot 2\pi f \cdot L) - j \cdot \frac{1}{2\pi f C}$$
$$= r + j \cdot \left(2\pi f L - \frac{1}{2\pi f C}\right)$$
$$= |Z_0| \cdot \varepsilon^{j\theta} \quad \cdots\cdots\cdots\cdots \text{(b)}$$

$$\left(\text{但し、}\theta = \tan^{-1} \frac{2\pi f L - \frac{1}{2\pi f C}}{r} \cdots\cdots \text{(c)}\right)$$

[0022] If the resonance circuit 4 which consists of the series circuit of resonant capacitor C and the high-frequency-induction-heating coil 6 is made into the resonance state, theta of the above-mentioned formula (c) will become theta= 0 degree. And resonance frequency f0 at this time It becomes as [show / in the following formula (d)].
[0023]
[Equation 3]

$$f_0 = \frac{1}{2\pi\sqrt{LC}}$$
$$\propto k_1 \cdot \frac{1}{\sqrt{L}} \quad \cdots\cdots\cdots\cdots \text{(d)}$$

（但し、k_1は定数）

[0024] The inductance L and relative permeability mus which, on the other hand, saw the high-frequency-induction-heating coil 6 from the power-source side under the condition of having put in the catalytic converter 9 in the high-frequency-induction-heating coil 6 Relation is in proportionality, as shown in drawing 3 , and if it expresses this with a formula, it will become like the following formula (e).
[0025]
[Equation 4]

$$L \propto k_2 \cdot \mu_s \quad \cdots\cdots\cdots\cdots \text{(e)}$$

（但し、k_2は定数、μ_s は比透磁率）

[0026] Moreover, relative permeability mus The relation with the temperature T of a heated object is a linear function as had an interrelative relation as shown in drawing 4 and shown with the following formula (f) in the specific region R. It seems that furthermore, the relation between the temperature T of a heated object and the inductance L of the high-frequency-induction-heating coil 6 is shown in drawing 5 .
[0027]
[Equation 5]

$$\mu_s = F(T) \quad \cdots\cdots\cdots\cdots \text{(f)}$$

[0028] Then, temperature T and resonance frequency f0 of the above-mentioned formula (d), (e), and (f) to a heated object If it asks for relation, it will become the following formula (g). In addition, if these relation is illustrated, it will become as [show / in drawing 6].
[0029]

[Equation 6]

$$f_0 = k_1 \cdot \frac{1}{\sqrt{L}} = k_1 \cdot \frac{1}{\sqrt{k_2 \cdot \mu_s}} = k_1 \cdot \frac{1}{\sqrt{k_2 \cdot F(T)}}$$

$$= K \cdot \frac{1}{\sqrt{F(T)}} \quad \cdots\cdots (g)$$

（但し、Kは定数）

[0030] Therefore, from the above-mentioned formula (g), they are temperature T and resonance frequency f0. It turns out that it has the correspondence relation of one to one mutually in the specific range. From this, he can understand that it is possible to detect the temperature T of a heated object (catalytic converter 9) indirectly based on resonance frequency f0.
[0031] A deer is carried out, in the equipment 1 of drawing 1 , in connection with an RF generator being supplied to a resonance circuit 4, the high frequency current flows to the RF induction heating coil 6, and, thereby, induction heating of the catalytic converter 9 is done by the RF power supply section 10 which consists of DC power supply 2 and an inverter 3. Under the present circumstances, while the output voltage v of the RF power supply section 10 is supplied to the PLL oscillator circuit 8 The high frequency current i which flows in the high-frequency-induction-heating coil 6 is supplied to the PLL oscillator circuit 8 through a current transformer 7. The control signal of the frequency f according to the high-frequency voltage v and the high frequency current i which are supplied to the PLL oscillator circuit 8 is inputted into said inverter 3 from the PLL oscillator circuit 8. It is controlled so that the high-frequency power of the same frequency f as the frequency f of said control signal will be supplied to a resonance circuit 4 by the RF power supply section 10 and this resonance circuit 4 will always be in the resonance state based on this.
[0032] That is, it follows on induction heating of the catalytic converter 9 being carried out, and the temperature rising, and is relative permeability mus. It follows changing and a resonance circuit 4 is always set as the resonance state by work of the PLL oscillator circuit 8. Thus, resonance frequency changes gradually, and when it becomes the frequency defined beforehand, the electric power supply from the RF power supply section 10 is stopped.
[0033] In this case, resonance frequency f0 of a resonance circuit 4 Whenever [stoving temperature / of a catalytic converter 9] can be set as necessary temperature by asking for relation with T beforehand whenever [stoving temperature / of a catalytic converter 9], and making the time of reaching the resonance frequency corresponding to whenever [desired stoving temperature] into the timing of the supply interruption of a power source.
[0034] Drawing 7 shows the example which used the circuit of drawing 1 , and shows the high-frequency-induction-heating temperature controller 12 concerning this invention. In addition, in drawing 7 , the same sign is given to the same part as drawing 1 , and the detailed explanation is omitted.
[0035] With the RF power supply section 10 where the equipment 12 of this example consists of DC power supply 2 and an inverter 3 as shown in drawing 7 The resonance circuit 4 which consists of a resonant capacitor 5 and the high-frequency-induction-heating coil 6, The phase control circuit 15 which consists of the PLL oscillator circuit 8 and the 1st and 2nd gate circuit 13 and 14, The flag signal generating circuit 16 which outputs a predetermined flag signal based on the output frequency from the PLL oscillator circuit 8, The flip-flop 18 which outputs the change signal for switching the circuit changing switch 17 for a heating halt to an OFF state from an ON state based on an above-mentioned flag signal is provided, respectively.
[0036] And the above-mentioned PLL oscillator circuit 8 consists of a phase comparator 20 which compares the phase of the high-frequency voltage v from an inverter 3 with the phase of the high frequency current i from a current transformer 7, a low pass filter 21 with which the output of this phase

comparator 20 is passed, and a voltage controlled oscillator 22 which operates based on the control voltage from this low pass filter 21.
[0037] On the other hand, the above-mentioned flag signal generating circuit 16 consists of frequency comparators 26 which output a flag signal to a flip-flop 18, when the output from the frequency counter 24 to which the output of the voltage controlled oscillator 22 of the PLL oscillator circuit 8 is supplied, the frequency setting machine 25 which can perform a setup of a frequency to arbitration, and this frequency counter 24 and the frequency setting machine 25 is measured and it becomes predetermined conditions.
[0038] Furthermore, the output of the voltage controlled oscillator 22 of said PLL oscillator circuit 8 is constituted so that it may be inputted into the 1st gate circuit 13. Moreover, while the output signal of said flip-flop 18 is inputted into the 2nd gate circuit 14, predetermined input voltage +V is inputted through said circuit changing switch 17. And the output signal from the 2nd gate circuit 14 is inputted into the 1st gate circuit 13, and it is constituted so that the output signal of this 1st gate circuit 13 may be supplied to said inverter 3 as a frequency control signal.
[0039] Next, it is as follows when actuation of the high-frequency-induction-heating temperature controller 12 of this example constituted in this way is described.
[0040] First, a circuit changing switch 17 is made by the ON state at the time of heating initiation, and it is set as the condition that the output frequency of the PLL oscillator circuit 8 is supplied to an inverter 3 through the 1st gate circuit 13 according to this.
[0041] If direct current voltage is supplied to an inverter 3 from DC power supply 2 under this condition, this direct current voltage will be changed into high-frequency voltage with an inverter 3. In this case, an inverter 3 is driven with the control signal supplied from the 1st gate circuit 13, and the high-frequency voltage v of the frequency f of said control signal and the same frequency is outputted from an inverter 3.
[0042] A resonance circuit 4 is supplied, the high frequency current flows in the high-frequency-induction-heating coil 6 according to this, into the high-frequency-induction-heating coil 6, induction heating of the catalytic converter (heated object) 9 by which insertion arrangement was carried out is carried out, and the temperature up of this high-frequency voltage v is carried out. In addition, in this case, a catalytic converter 9 is gradually heated from that periphery side, as shown in drawing 8 , and as the temperature T of a catalytic converter 9 shows drawing 9 with progress of heating time t, it changes.
[0043] The high frequency current which flows in the high-frequency-induction-heating coil 6 at the time of above-mentioned induction heating is inputted into a phase comparator 20 through a current transformer 7. And in this phase comparator 20, the phase comparison of the output voltage v from the high frequency current i and inverter 3 from a current transformer 7 is carried out mutually, and the voltage signal proportional to the phase contrast of said high frequency current i and output voltage v is outputted from a phase comparator 20. Subsequently, a higher harmonic is removed by the low pass filter 21, and the output voltage of a phase comparator 20 is changed into direct current voltage, and is supplied to a voltage controlled oscillator 22.
[0044] In this way, as for the PLL oscillator circuit 8, the phase of the high frequency current i operates so that the frequency f of the oscillation output of a voltage controlled oscillator 22 may become high to the phase of output voltage v in the case of a leading phase (theta< 0 degree), and contrary to this, to the phase of output voltage v, the phase of the high frequency current i operates so that the frequency f of the oscillation output of a voltage controlled oscillator 22 may become low in the case of a delay phase (theta> 0 degree).
[0045] On the other hand, if the frequency f of the supply voltage supplied from an inverter 3 in the resonance circuit 4 which consists of the series circuit of a resonant capacitor 5 and the high-frequency-induction-heating coil 6 (namely, the oscillation frequency f of a voltage controlled oscillator 22) becomes high, the phase of the high frequency current i will carry out actuation to which the phase of the high frequency current i progresses to the phase of output voltage v, if the frequency f of said supply voltage becomes low contrary to delay and this to the phase of output voltage v. and if a resonant capacitor 5 and the high-frequency-induction-heating coil 6 will resonate and a resonance circuit 4 will

be in the resonance state, the phase contrast of output voltage v and the high frequency current i will be lost (theta= 0 degree) -- it operates like.
[0046] Therefore, the output voltage of the phase comparator 20 in the PLL oscillator circuit 8 is in the condition of negative feedback to the oscillation frequency f of a voltage controlled oscillator 22, and automatic control is carried out so that it may be in the resonance state, the condition 4, i.e., the resonance circuit, whose phase contrast theta of output voltage v and the high frequency current i is finally 0 degree.
[0047] In addition, it follows on the rise of whenever [stoving temperature / of a catalytic converter 9], and is relative permeability mus. Like previous statement, it changes and is resonance frequency f0. Although it will shift, a setup which will always be in the resonance state automatically by phase lock actuation by the PLL oscillator circuit 8 is performed, and tailing actuation to the resonance state is automatically performed by making the oscillation frequency f into a parameter. Thereby, it is resonance frequency f0. It changes, as shown in drawing 10 with progress of heating time t.
[0048] On the other hand, the output frequency of said voltage controlled oscillator 22 is inputted into a frequency counter 24, and the oscillation frequency f is changed into a digital signal in this frequency counter 24. And this digital signal is inputted into the frequency comparator 26, and is compared with the set point of the frequency setting machine 25. In addition, setting actuation of the set point asks for the relation of whenever [resonance frequency and stoving temperature] beforehand about the catalytic converter 9 which should be heated, and is performed by doubling with the numeric value of the resonance frequency corresponding to whenever [desired stoving temperature].
[0049] When the frequency of a frequency counter 24 becomes more than the frequency of the frequency setting machine 25, a flag signal is outputted from the frequency comparator 26, and this flag signal is inputted into a flip-flop 18, and is held. According to this, a predetermined heating stop signal is inputted into the controller outside drawing from a flip-flop 18. And while this heating stop signal is inputted into the 2nd gate circuit 14, based on said heating stop signal, a circuit changing switch 17 is switched to an OFF state from an ON state, and the input of power-source +V to the 2nd gate circuit 14 is intercepted. In connection with this, the frequency output of the PLL circuit 8 is intercepted in the 1st gate circuit 13, and the input to an inverter 3 is lost.
[0050] Consequently, the supply of high-frequency voltage to a resonance circuit 4 is intercepted, and induction heating is suspended immediately after a catalytic converter 9 reaches necessary laying temperature.
[0051] According to the high-frequency-induction-heating temperature controller 12 like ****, a resonance circuit 4 can always be made into the resonance state, and induction heating of the catalytic converter 9 can be correctly carried out to necessary temperature by making into a parameter resonance frequency f0 which changes with the rise of whenever [stoving temperature / of a catalytic converter 9]. Namely, resonance frequency f0 Since the temperature T of the catalytic converter 9 to receive has the relation of one to one shown in drawing 11 , Resonance frequency f0 By inputting the numeric value to said frequency setting machine 25 beforehand Generating of the situation which will be overheated more than a situation in which it can be set as the temperature of a request of whenever [stoving temperature / of a catalytic converter 9], therefore a catalytic converter 9 is not heated by even laying temperature, or laying temperature can be prevented certainly.
[0052] In addition, although a heated object is a catalytic converter 9 in this example, in carrying out induction heating, the actual condition produces a temperature gradient from this catalytic converter 9 being a spiral winding object like previous statement greatly in that periphery part and inner circumference part. Therefore, what is necessary is just to ask beforehand for the relation between whenever [stoving temperature], and resonance frequency the bottom of conditions which become more than whenever [of a request of the amount of about 75% of periphery flank / stoving temperature] among the whole surface products of the cross section which intersects perpendicularly with the axis of a catalytic converter 9, for example, although how whenever [stoving temperature / of a catalytic converter 9] should be appointed poses a problem.
[0053] As mentioned above, although attached and stated to the example of this invention, this invention

is not limited to this example and various kinds of deformation and modification are possible for it based on the technical thought of this invention. For example, the detection means of a flag signal, the heating cutoff means based on a detection part and a flag signal, etc. can be changed suitably if needed. Moreover, the control approach and a high-frequency-induction-heating temperature controller do not need to say that it is applicable also to induction heating of not only the catalytic converter 9 but various kinds of heated objects whenever [stoving temperature / of this invention].
[0054]
[Effect of the Invention] Like the above, this invention makes the resonance state the resonance circuit which has a high-frequency-induction-heating coil, and induction heating of the heated object can be carried out to necessary temperature correctly and quickly, without using a thermocouple sensor, a timer, etc., since whenever [stoving temperature / of said heated object] is controlled by the bottom of this resonance state based on the resonance frequency which changes in connection with the temperature rise of a heated object. That is, since it is made to detect whenever [stoving temperature / of a heated object] by making resonance frequency at the time of induction heating into a parameter, compared with the case where can perform induction heating of a heated object upwards with high degree of accuracy, and a thermocouple sensor is used, temperature detection can be carried out extremely at high speed, as a result shortening of a heating duration can be attained.
[0055] Moreover, although the variations on the dimension of a heated object (deformation, eccentricity, etc. of a configuration) exist not a little, and there is moreover a possibility that it cannot heat to predetermined temperature, by quality-of-the-material degradation accompanying aging even if it switches on fixed power by the conventional approach using a timer According to this invention, since he is trying to use resonance frequency as a detection means of whenever [stoving temperature], induction heating can always be carried out to desired temperature, without being influenced of aging about each heated object, and it is very practical.

[Translation done.]